United States Department of Agriculture
Animal and Plant Health Inspection Service
Plant Protection and Quarantine
Port of Seattle Office
16215 Air Cargo Rd.
Suite 112
SeaTac Intern'l Airport
Seattle, WA 98158-1301

Subject: **Cold Calibration of Cold treatment Facilities for Export of Fruit**

Date: August 27, 2000

To: Cold Room Calibrators

The following procedures should be used to Calibrate Cold Treatment Facilities for Export.

1. The temperature recorder should be working prior to beginning the calibration test. Strip Chart recorders and Data loggers should be in operation at least 30 minutes prior to the beginning of the tests.

2. Individual sensors must be checked to verify they are properly labeled and correctly connected to the temperature recorder. This may be accomplished by hand warming each sensor individually. A temperature increase should be detected for the sensor being warmed.

If the instrument fails to react. The sensor is probably incorrectly connected, incorrectly labeled, or the print cycle is out of sequence. Diagnosis and correction of the problem by the instrument representative will probably be required.

You may also verify the sensors are correctly labeled by watching for a temperature change when each sensor is removed from the ice water mixture after the first temperature reading, or by hand warming the sensor between ice water temperature readings.

3. If insulated containers are used for the ice water calibration test, it is not necessary to lower the temperature of the cold treatment room. When using non-insulated buckets the temperature in the treatment room should be lowered to near 0°C (32°F) for the calibration test. Do not use metal buckets. The metal may effect the sensor readings.

4. Make sure you have access to clean containers, clean commercial crushed ice, and clean distilled water before the ice water mixture is prepared. Distilled water should be used to insure accurate readings. If distilled water is not used, the mixture should be tested with a calibrated thermometer capable of reading 10ths of a degree to ensure that the ice water mixture is very near 0°C (32°F).

5. Fill the container approximately one half full with clean crushed ice. Add only enough water to cover but not float the ice. This will result in a homogenous mixture of approximately 50/50 ice and water.

The ice water must be carefully prepared and maintained to keep the temperature consistently at 0°C (32°F).

As ice in the mixture melts you will no longer have a consistent mixture. The ice will begin to float to the top of the water and the temperature of the mixture will rise above 0°C. Water must be removed or ice added to regain the homogenous ice water mixture. Stir the mixture to attain a consistent temperature throughout.

A calibrated thermometer may be used to verify the ice water mixture has stabilized at 0°C (32°F). The temperature of the ice water mixture may also be checked periodically to insure the mixture is being properly maintained.

6. Submerge the entire sensor tip into the ice water mixture without touching either the sides or the bottom of the container. Allow a few seconds for the sensor(s) to equalize before testing. The mixture should be gently stirred while testing. Leave the sensor in the ice water until the reading has stabilized at a consistent temperature. Note: The Mexico work plan requires that each probe stabilize in less than three minutes of immersion.

7. Any sensor which reads **more than** plus or minus 0.3°C from the standard of 0.0°C (more than plus or minus 0.5°F from the standard of 32.0°F) must be either corrected by calibration adjustments or replaced.

8. Any sensor which reads plus or minus 0.3°C **or less** from the standard of 0° c. (plus or minus 0.5°F or less from the standard of 32°F) must be corrected by calibration adjustments, or the use of a correction factor.

CALIBRATION ADJUSTMENT METHODS INCLUDE:

Option A. Corrections may be made with the software or through other calibration equipment to adjust the reading to 0.0°C (32°F).

Option B. If the reading can not be corrected to 0.0°C (32.0°F) it may be corrected to fall within -0.3° to +0.3°C (31.5° to 32.5°F) and a correction factor must be applied.

A correction factor must now be applied all readings from that sensor. The correction factor is the variance from 0.0°C (32.0° F) registered by the sensor. For instance: if the ice water mixture is 0.0°C and the sensor registers 0.2°C. The correction factor for the sensor is -0.2°C.

Option C. If the reading can not be adjusted to read within -0.3°C to +0.3°C (31.5°F to 32.5°F) the probe must be replaced.

The following graphically show the temperature ranges referred to above.

The underlined type shows the range of temperatures where the variance from 0°C (32°F) is too great to correct the temperature by use of a correction factor. The sensor must be replaced if the sensor can not be recalibrated to fall within the bold printed range. The **Bold Print** shows the range of temperatures where the variance may be corrected by the use of a correction factor.

					Degrees Celsius							
-0.6	-0.5	-0.4	**-0.3**	**-0.2**	**-0.1**	**0.0**	**+0.1**	**+0.2**	**+0.3**	+0.4	+0.5	+0.6
					Degrees Fahrenheit							
30.9	31.1	31.4	**31.5**	**31.6**	**31.8**	**32**	**32.2**	**32.4**	**32.5**	32.6	32.9	33.1

9. Two readings of the sensor must be taken and the warmer reading recorded on the TEMPERATURE PROBE CALIBRATION CERTIFICATE before the sensor calibration is certified.

A variance between the two readings of **more than** 0.1° C. or F. is cause for rejection of the sensor. When the variance between the two readings is **less than or equal to** 0.1° Celsius or Fahrenheit the warmer reading should be used when determining the correction factor.

11. Record each sensor's correction factor on the TEMPERATURE PROBE CALIBRATION CERTIFICATE. **A cold treatment room should not be approved unless all sensing elements are acceptable for certification.**

12. Once all of the probe readings and identifications are complete and calibrated for the room complete the certificate.

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Correction Factor Examples and Illustrations

Example 1:

The maximum treatment temperature is 0.0° C.
The sensor records a constant temperature of 0.3°C with a correction factor of -0.2°C.

The treatment fails: subtract the 0.2° correction factor from the 0.3° reading to get the true corrected temperature of 0.1°C.

Example 2:

The maximum treatment temperature is 0.0°C.
The sensor records a constant temperature of 0.1°C
With a correction factor of -0.2°C

The treatment passes: subtract the 0.2° correction factor from the 0.1° reading to get the true corrected temperature of -0.1°C.

Example 3:

While calibrating a single sensor, for the first test, the sensor records a temperature of 0.1°C. For the second test, the sensor records a temperature of 0.2°C. Does this sensor pass and what is the correction factor?

The sensor passes (the two readings vary by 0.1°C or less) and the correction factor is -0.2°C.

Example 4:

While calibrating some sensors, you notice one sensor reads 32.6°F. While all of the other sensors have stabilized at 32.0°F. What do you do?

Either the sensor must be adjusted to 32.0°F or replaced. A correction factor cannot be applied since the error is more than 0.5°F.

Example 5:

While calibrating a sensor, you find that it first reads 31.8°F, but the second reading is 31.9°F. Which reading would you use to determine a correction factor? And what would the correction factor be? If the second reading was 32.0°F?

You would use the warmer reading 31.9°F for a correction factor of +0.1°F. If the two readings vary by more than 0.1°F reject the sensor.